Maintaining Situation Awareness with Autonomous Airborne Observation Platforms

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Unmanned Aerial Vehicles (UAVs) offer tremendous potential as intelligence, surveillance and reconnaissance (ISR) platforms for early detection of security threats and for acquisition and maintenance of situation awareness in crisis conditions. However, using their capabilities effectively requires addressing a range of practical and theoretical problems. The paper will describe progress by the "Autonomous Rotorcraft Project," a collaborative effort between NASA and the U.S. Army to develop a practical, flexible capability for UAV-based ISR. Important facets of the project include optimization methods for allocating scarce aircraft resources to observe numerous, distinct sites of interest; intelligent flight automation software than integrates high-level plan generation capabilities with executive control, failure response and flight control functions; a system architecture supporting reconfiguration of onboard sensors to address different kinds of threats; and an advanced prototype vehicle designed to allow large-scale production at low cost. The paper will also address human interaction issues including an empirical method for determining how to allocate roles and responsibilities between flight automation and human operations.

Michael Freed is the inventor and project lead for the Apex autonomy architecture, a tool for developing autonomous systems operating in uncertain, time-pressured task environments. Dr. Freed's research activities include work in AI planning and plan execution, model-based reasoning, human-system modeling and human factors. He is currently autonomy lead for the Autonomous Rotorcraft project ongoing at Ames in conjunction with the NASA-Army rotorcraft flight controls division and deputy-lead of the Mars Science Laboratory autonomy infusion project.